Code No. 6016

FACULTY OF ENGINEERING

B.E. 2/4 (ECE) I-Semester (Main) Examination, November 2013

Subject : Electromagnetic Theory

Time : 3 Hours **Max. Marks: 75**

Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

1. Describe the three orthogonal surfaces that define the cylindrical co-ordinates of a point. (3)
2. State and briefly discuss the basic definition of the divergence of a vector. (3)
3. For a line charge $\ell_L = \frac{10^{-9}}{2}$ c/m on the z axis. Find V_{AB} where A is $(2m, \frac{\pi}{2}, 0)$ and B is (4m , π, 5m). (3)
4. Find the current crossing the portion of the y=0 plane defined by $-0.1 \le x \le 0.1$m and $-0.002 \le z \le 0.002$m. If $J = 10^2 | x | a_y$ A/m. (3)
5. State Biote-Savart's law. (2)
6. Find the inductance of an Ideal solenoid with 300 turns, ℓ = 0.50m and a circular cross section of radius 0.02m. (3)
7. List out the generalized forms of Maxwell's equation in differential form for the static fields. (2)
8. What is a uniform plane wave? (2)
9. What is loss tangent? Discuss its significance. (2)
10. Define Brewster and critical angles. (2)

PART – B (50 Marks)

11. (a) Two infinite sheets with charge densities of $8nc/m^2$ and $-8nc/m^2$ are locates at y=-4m and respectively. Find the electric field at origin. (4)
    (b) Obtain the expression for the electric field due to an infinite line charge at any radial distance. (6)

12. (a) Find the potential at r_A = 5m with respect to r_B = 15m due to a point charge Q = 500pc at the origin and zero reference at infinity. (5)
    (b) Derive the expression for the electro static energy stored in a capacitor of value (C) in terms of the total charge (Q) as well as the voltage (V). (5)

13. (a) Explain the nature of line, surface and volume current distributions as applicable to static magnetic fields. List out the expressions for the magnetic field intensity in these three cases. (6)
    (b) A conductivity plane at y = 1 carries a surface current of 10z mA/m. Find 'H' and 'B' at (0, 0, 0) and at (2, 2, 2). (4)

14. (a) What is a boundary condition? How do boundary conditions arise and how are they derived? Discuss the boundary conditions on the surface of a perfect conductor. (6)
    (b) Find the inductance of an ideal solenoid with 300 turns ℓ = 0.50m and a circular cross section of radius 0.02m. (4)

15. (a) What is the inconsistency in Amperes law ? How it is rectified by Maxwell? (5)
    (b) From the Maxwells curls equation derive the wave equations for an electromagnetic wave in free space. (5)

16. (a) Determine the resultant electric and magnetic fields of a plane wave. When it is incident on a perfect conductor normally. (5)
    (b) A perpendicularly polarized wave is incident at an ingle of $\theta_i = 15^o$. It is propagating from medium 1 to medium 2. Medium 1 is define by E_{r1} = 8.5, μ_{r1} and σ_1=0 and medium 2 is free space. If E_i = 1.0 mv/m determine E_r, H_i, H_r, E_t and H_t. (5)

17. (a) Explain skin depth and derive expression for depth of pentration for good conductor. (5)
    (b) An EM wave is propagated through a material having μ_r =5 and E_r=10 . Determine the (i) velocity of propagation (ii) Intrinsic impedance (iii) wave length. If the frequency is 1 GHZ. (5)

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